ROYAL GARDENS, KEW.

BULLETIN

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DXLIII.—A LILY BULB DISEASE.

(*Rhizopus necans*, Mass.)

With Plate.

During the past year a destructive wave of fungoid disease almost completely ruined the crop of lily bulbs raised in Japan for exportation to Europe. The first indication of this disease received at Kew, was through Messrs. Tozer, Bros. and Co., of Gracechurch Street, who sent a large number of diseased bulbs for examination. These bulbs formed part of a consignment received from Japan in November last, consisting of 848 cases, containing 73,050 bulbs of *Lilium speciosum*, Thunb., "album" and "rubrum." Out of this number only 250 bulbs arrived in a saleable condition, the whole of the remainder being more or less rotten and worthless. At a later date the same firm received a second consignment of 37,590 very large bulbs of *Lilium auratum*, and out of this quantity only 4,000 were saleable. Similarly diseased bulbs, received from Japan, were afterwards sent to Kew for examination from other sources. Finally, a quantity of bulbs obtained through an agent from Japan, for planting at Kew, contained a large percentage suffering from the same type of disease.

The bulbs received for investigation showed every stage of disease; in the earliest condition, the base of the bulb is alone discoloured and somewhat soft; this discolouration and softening of the tissues gradually spreads from the base, until finally, in the most advanced stage, every part of the bulb is of a brownish colour, and sufficiently soft to admit of being readily crushed into a pulpy mass between the fingers.

Microscopic examination revealed the presence of slender, continuous, hyaline, branched hyphae traversing the tissues in every direction; the cell-walls are never pierced, but gradually dissolved, and it is only at the last stage of the disease that the starch-grains become irregularly corroded, and gradually dissolved.

So long as the epidermis of the bulb-scales remains intact there is no trace of mycelium or fructification on the surface, but when the tissue is reduced to a soft pulp, or when a diseased bulb is cut open, the broken surface is within 24 hours covered with a dense snow-white mycelium, which within three days becomes studded with numerous clusters of fruit, resembling to the naked eye miniature pins with round black heads. The occurrence of this particular form of fungus on every bulb examined suggested that it might possibly be in some way associated

with the disease, and subsequent cultures and inoculations proved this surmise to be correct.

The fungus grows readily as a saprophyte; the spores germinating and forming the characteristic superficial white floccose mycelium, which within a week bears an abundance of fruit, on such varied culture media as prune juice, sterilised potato, decoction of bulb scales, &c. In one experiment four spores were sown in a 5 per cent. solution of cane-sugar in water in a Petri dish, and at the end of six days the entire surface of the liquid was covered with the fungus in a fruiting condition.

When spores were sown in a hanging-drop along with a very thin section of lily bulb-scale, it was observed that the germ-tubes could not enter the tissue through the epidermis, but that they entered readily at those points where the cells were not protected by the epidermis.

A set of experiments were also carried out, using healthy lily bulbs, some of which were furnished by Messrs. Tozer, for inoculation. For the purpose of destroying stray fungus spores the bulbs were immersed for a quarter of an hour in a 1 per cent. solution of corrosive sublimate. The bulbs were afterwards placed in wide-mouthed flasks filled with sterilised tap-water containing a 5 per cent. solution of cane-sugar, the base of the bulb being immersed in the liquid; finally, the entire bulb was covered with a sheet of cotton wool, soaked in a 1 per cent. solution of corrosive sublimate, the cotton wool being tied round the neck of the flask. When the roots were about an inch long an attempt at inoculation was made as follows:—The numerous cultures of the fungus furnished a large supply of spores, which were tested and found to germinate readily. These spores were collected with a wet camel-hair brush and washed off into a small amount of sterilised water in a flask until it became discoloured by the quantity of spores present; this was the inoculating material. A quantity of this spore-carrying water was added to the water in which two of the bulbs were growing, care being taken not to injure the roots; the inoculating liquid was also deposited freely between the scales of the two bulbs, which were then covered with sterilised cotton wool as before. The water in which two other bulbs were growing was inoculated as above, but the roots of the bulbs were broken off.

Finally, 1 per cent. of salicylic acid was added to the water in which two more bulbs were growing, a copious supply of the inoculating water added, the roots of the bulbs broken off, the bulbs replaced, and, as in the other instances, protected with cotton wool.

At the end of six weeks the two bulbs whose roots were not destroyed appeared to be quite healthy; they were then planted in soil, and are still growing and show no indication of disease. The two bulbs with broken roots showed signs of disease at the end of three weeks after inoculation, and at the six weeks period the disease had extended nearly half-way up the bulb from the base, as shown in fig. 1, which was drawn from this specimen. After being cut open the same kind of fungus showed itself on the surface that has been described as occurring on the bulbs received from Japan. The companion bulb was also diseased, and in about three months was soft and rotten, and covered with the fungus in a fruiting condition. The two bulbs with broken roots that were growing in water containing 1 per cent. of salicylic acid remained quite healthy, made fresh roots, and are still living.

Numerous experiments were made with other kinds of bulbs, and it was found that the fungus refused to grow on onions, however much mutilated. On the other hand, daffodil bulbs are very susceptible to the

disease; if the roots are broken, or a wound made in the bulb, and afterwards powdered with the spores, the disease showed itself within a a few days, and was in due course followed by the characteristic fruit of the fungus. It was invariably found that, however much bulbs were mutilated, and then inoculated with fungus spores, that submergence for a few minutes in a 1 per cent. solution of salicylic acid, or corrosive sublimate prevented the disease; in other words, all fungus spores coming in contact with the above-named solutions are destroyed, whereas the vitality of the bulbs thus treated is not at all affected.

Dr. Halstead has described* a somewhat similar disease, called "soft-rot," as attacking the sweet potato in the United States. The fungus causing this disease, *Rhizopus nigricans*, Ehrh., is closely allied to the species under consideration causing the lily bulb disease.

In addition to the kind of fungus fruit already described, a second form, of sexual origin, called a zygospore, is present in the genus *Rhizopus;* several large, spiny zygospores were found in the matted mycelium present on bulbs in the last stage of decay, and presumably belong to our fungus. Zygospores differ from the minute spores already described in requiring a somewhat lengthened period of rest before they germinate, by this means tiding the fungus over that period of the year not suitable for its growth, and germinating when favourable conditions, climatic and otherwise, return. During this period of rest, the zygospores remain in the soil, or attached to the substance on which they were produced. The minute spores previously described, possess the capacity of germination the moment they are mature, and enable the plant to extend its area of distribution; and as these spores are produced very quickly, and in immense numbers, it can readily be understood how rapidly the disease spreads when once introduced into a given locality.

The fungus causing the lily bulb disease, although allied to *Rhizopus nigricans*, is quite distinct from this and every other known species, and may be characterised as follows :—

Rhizopus necans (n. sp.).

Hyphis sterilibus continuis conglomeratis intricatis tenuibus candidis; hyphis sporangiferis erectis simplicibus vel interdum furcatis 3–6-fasciculatis continuis flavo-brunneis 20–25 μ diam. circa 2 mm. altis basi stolones longos emittentibus; sporangiis globosis circa 250 μ diam. brunneo-nigris opacis glabris; columella subglobosa; sporis subglobosis minutissime striatis 5–6 μ diam. pallide olivaceo-brunneis; zygosporis doliformibus 100–120 μ diam. hispidis subnigris.

Parasitic on bulbs of various species of *Lilium*.

Japan.

Summary.

The lily bulb disease is caused by a parasitic fungus called *Rhizopus necans*.

The fungus cannot penetrate the unbroken tissues of the bulb, but gains an entrance through wounds, more especially broken roots.

The amount of evidence forthcoming indicates that the bulbs are not diseased until after they are removed from the ground.

The spores of *Rhizopus necans* are killed by a short immersion in a 1 per cent. solution of corrosive sublimate or of salicylic acid.

* New Jersey Agric. Coll. Expt. Station, Bull. n. 76.

Neither of these substances have any injurious effect on living bulbs, provided they do not remain in the liquid for more than fifteen minutes.

Preventive Measures.

The fungus is by no means confined to lily bulbs for its food; but, as experiments have proved, can live on a great variety of dead or decomposing substances; it may also occur as a parasite on other plants than lilies in Japan as it readily attacks and destroys daffodil bulbs. Judging from the enormous amount of injury caused, it would appear that the fields where the lilies are grown, must be saturated with the fungus, growing indiscriminately on various substances, and attacking the lily bulbs, along with other things, as a matter of course. If practicable, entirely new localities should be selected for the work. Even if this were done, great care would have to be exercised, so as not to introduce the fungus; the spores are readily conveyed from one locality to another in the soil on tools, cart wheels, shoes, clothing, &c., in addition to being carried by wind or animals. An important point to remember is not to allow vegetable rubbish of any kind to accumulate, and all diseased bulbs should be burned and not allowed to remain on the ground, otherwise the zygospores that form on such old decaying bulbs would start the disease the following season.

As little injury as possible should be done to the roots of the bulbs when they are removed from the ground, and the bulbs should be allowed to "sweat" before they are packed for exportation. If the fungus is known to be present when the bulbs are being prepared for packing, they might be placed in a solution of salicylic acid as advised.

The sterilised earth in which the bulbs are packed appears very suitable for the work, and cannot be in any way considered as a cause of the disease.

G. Massee.

Description of the Figures.

1. Section of a diseased lily bulb; the dark portion at the base of the bulb is the part attacked by the fungus; nat. size.

2. Portion showing the fungus in the fruiting condition, growing on the roots of a lily; × 2.

3. Clusters of fruit-bearing branches of the fungus; × 8.

4. A single cluster of the sporangial form of fruit; × 60.

5. Diagramatic section of a sporangium; *a*, columella; the portion, *b*, between the columella and the outer wall of the sporangium is filled with spores.

6. Spores, some of which are germinating; × 300.

7. Spores showing the delicate markings on the epispore; × 1,000.

8. Mature zygospore; × 300.

9. Mycelium of the fungus running between cells filled with starch; × 400.

DXLIV.—TENGAH BARK.

The species of the small natural group of Mangroves form one of the most characteristic features of the muddy tidal estuaries of the tropics. *Rhizophora*, the typical genus, is found in both the old and the new world; the others are confined to the former.

The *Kew Bulletin* for 1892 (pp. 227–232) contained a full account of an attempt to introduce West Indian Mangrove bark into European commerce as a tanning material.

The present correspondence gives the available information respecting one of the East Indian Mangroves, *Ceriops candolleana*, which appear to be attracting some attention.

Director, Gardens and Forest Department, Straits Settlements, to Royal Gardens, Kew.

Singapore,
November 8, 1892.

Dear Mr. Thiselton-Dyer,

I am sending you a small box of extract of Tengah bark (*Ceriops candolleana*). This bark is used here for tanning, and also for dyeing, especially in conjunction with Indigo. The bark was cut up in bits and boiled for two hours in a copper pan, and the liquid eventually dried by heat.

In dyeing, it is used to give a brownish red colour to cloth, but especially to get good black and purple. The cloth is first dyed in Tengah, dried, and then dipped in Indigo, and comes out purple or black according to the strength used.

The tree is very common here and used as firewood, and the bark mostly wasted. So it could be prepared at no great cost. I should be glad if you would get an opinion on it either as either a dye or a tan.

Mangrove extracts have, I believe, been tried before, but have not been successful, because there has not been any attempt to discriminate between the species, but all kinds of barks have been stewed up together and the result tried. Now, I am going to work through all the Mangrove tan barks one by one, and try if we cannot make some use of them.

Yours, &c.
(Signed) Henry N. Ridley.

Note by the Professor of Dyeing, Yorkshire College, Leeds.

"Tengah" bark extract behaves, as regards its dyeing properties, in a similar manner to a good quality of Catechu.

When used along with Indigo, as is apparently the practice, the latter is probably applied in a "copperas" (ferrous sulphate) vat; in which case the "Tengah" will combine with the iron and produce, as indicated above, a grey colour, which in conjunction with the Indigo blue gives the black.

Tengah extract would certainly be of value to dyers.

(Signed) J. J. Hummel.

February 8, 1893.

MESSRS. WALLACE BROTHERS to ROYAL GARDENS, KEW.

8, Austin Friars, London, E.C.,
February 11, 1897.

SIR,

WE are sending you by parcel post a sample of Mangrove bark from British North Borneo, which we understand is known there as Kulit Tengah Mangrove. From this bark a substance is produced which is used largely in dyeing, and we shall feel much obliged if you will inform us whether the particular description of Mangrove tree from which this bark is produced is found in British Burma. There are, we know, large quantities of Mangrove trees in Burma, but we are not sure if they consist of the particular description represented by the sample we are sending you.

We understand that the common Mangrove, generically known in Borneo as Bakau, also produces a dye, but of a darker colour than the Tengah.

Perhaps you can oblige us with the botanical names of the Tengah and of the common Mangrove.

We are, &c.
(Signed) WALLACE BROTHERS.

W. T. Thiselton-Dyer, Esq., C.M.G., F.R.S.,
Director, Royal Gardens, Kew.

ROYAL GARDENS, KEW, to Messrs. WALLACE BROTHERS.

Royal Gardens, Kew,
February 12, 1897.

SIRS,

I AM in receipt of your letter of yesterday's date.

Tengah bark is an article known to us only from the Straits Settlements. Its botanical name is *Ceriops candolleana*. It belongs to the mangrove family, and no doubt occurs both in Borneo and in all the tidal rivers of British India. It has been studied in the Leeds Dyeing School, and was regarded as "of value to dyers."

2. I should he disposed to regard the article known as "Bakau Cutch" as possibly derived from the same plant as the "Tengah extract."

3. The two species of mangrove which are widely dispersed throughout the eastern tropics are *Rhizophora mucronata* and *Rhizophora conjugata*.

I am, &c.
(Signed) W. T. THISELTON-DYER.

Messrs. Wallace Brothers,
8, Austin Friars, London, E.C.

DXLV.—WEST INDIA SUGAR TRADE.

The following article is reproduced from the *Times* of November 30th last. It gives an extremely clear account of the state at that date of the problem of sugar cultivation in British Colonies and the cause of its decay. And it is the more valuable as it does this from an impartial and independent point of view:—

"The position of the West Indian sugar trade, which has led to the appointment of an Imperial Commission to proceed to the West Indies

and inquire on the spot into the conditions of the sugar industry, with a view to ascertaining whether any effective measures can be devised for its development and relief, is one which can hardly fail to arouse both sympathy and interest.

"It would be in every sense undesirable, on the eve of such an inquiry as is now about to be held, to take conclusions for granted on the many controversial points with which the subject bristles. There is no necessity to assume, on the one hand, that the industry is the altogether hapless victim of circumstances which are beyond the range of possible control, or, on the other, that with proper exertion on the part of those who are most largely interested the evils complained of might in spite of circumstances have been surmounted. An unbiassed statement of facts, a due apportionment of praise and blame, an unprejudiced recommendation of the proper remedies are what the public will look for from the Commission. In the meantime a bare outline of the situation as it presents itself, whatever the causes or combination of causes by which such situation may have been produced, will indicate the urgency of according full consideration to the question.

"It has to be borne in mind that the West Indian colonies are principally agricultural in their resources. With the exception of British Guiana, where the development of the gold industry is now confidently expected, they have so far given little indication of mineral wealth. Their position and the nature of their labouring population preclude the idea of manufacturing development on any important scale. Amongst their agricultural productions sugar has hitherto held the principal position. In British Guiana, which is the largest sugar-producer of the group, the sugar industry, notwithstanding the promise of other developments in the near future, is still spoken of as practically the only industry of the country. It is the industry which has hitherto contributed the principal revenue. It is also, it should be added, the industry in whose interests the incidence of taxation of the colony has been principally adjusted. It is worth stating, as having a possible bearing upon the future solution of present difficulties, that, although the cultivation of sugar has hitherto occupied this very prominent position in the agricultural production of British Guiana, there is no natural dearth of other tropical products which might in favourable circumstances be brought into commercial cultivation. In Jamaica the proportion of sugar cultivation to other agricultural production has of late years diminished, and the prosperity of the colony stands on a wider basis. Bananas and other tropical fruits, cacao, coffee, cocoa nuts, cinchona bark, &c., form a considerable item in the trade of Jamaica. The development given to the fruit trade and the fibre industry in the Bahama Islands proves the value of products which have hitherto been regarded as possessing only minor importance in the possible resources of tropical and sub-tropical agriculture. In relation to these as yet scarcely developed possibilities, it has been pointed out that we have 'in British Guiana alone an area of country equal to two Ceylons quite untouched; in British Honduras we have more than the area of the Fiji Islands; to Trinidad we could add the wealth of the Straits Settlements, and with the resources of the unworked soil of Jamaica we might emulate the prosperity of at least four colonies of the size of Mauritius.'

"Acknowledging to the full all that there may be to urge in favour of further development of other agricultural resources, we must, however, recognise that sugar is at present and has been for many years past the principal mainstay of West Indian production. In British Guiana

sugar and its accompanying products have been calculated to contribute 92 per cent. of the total exports, in Barbados 94 per cent. St. Kitts, St. Lucia, St. Vincent, and other smaller islands are in a very similar position. In Jamaica, notwithstanding the development of other industries, sugar only forms 20 per cent. of the total export.* Trinidad, happy in the possession of a pitch lake, counts sugar as its staple production. With rare exceptions the West Indian Colonies may be correctly stated to regard the prosperity of the sugar industry and the prosperity of their local populations as synonymous terms. Depression in the sugar trade means for them financial embarrassment in private circles, diminution of the public revenue, discontent among the labouring population.

"It is a matter of common knowledge that depression in the West Indian sugar trade has now reached a point at which estates are going out of cultivation in some of the leading sugar colonies, and very serious consequences are anticipated both to the public and to the private prosperity of the colonies affected. Remedial measures have become urgently necessary in order to avert grave disaster. The cause of the crisis is not to be attributed to a lessened demand for sugar in the markets of the world, nor to a diminished power of production. The total sugar production of the world for the year 1880 was 3,830,000 tons. The total production of the world for the year 1895 was 7,879,000 tons. The increase is large for a period of 15 years, and if the West Indian Islands had kept a fair proportion of the increased production in their hands they ought to have no reason to complain. Unfortunately, this is not the case. The sugar of the world is of two kinds, cane sugar and beet sugar. The West Indians are producers of cane sugar alone, and when the total of the world's sugar production is divided under the two heads of cane and beet it will be found that the increased production has been almost wholly in beet sugar. The figures for 1880 are:—Cane sugar, 2,200,000 tons; beet sugar, 1,630,000 tons; and the figures for 1895 are—cane sugar, 2,904,000 tons: beet sugar, 4,975,000 tons. Nearly the whole increase has been made in the production of beet sugar, and while these large quantities have been added to the general supply placed upon the markets of the world, the production of cane sugar in the West Indian colonies has remained for many years in quantity almost stationary. Had it remained stationary in value the situation might still have been endurable, but the natural effect of increased supply in bringing down the level of prices has been artificially heightened by a system of foreign bounties, on the one hand, and of duties, on the other, until in the course of last year prices fell to something not far from 50 per cent. of the values realized in the comparatively recent days of West Indian prosperity, According to a statement made before a local Commission, appointed in 1894 to inquire into the matter, in British Guinea a ton of refined cane sugar cost 14*l.* 15*s.* 10*d.* to produce, and its average value in the market at that time was 13*l.* 19*s.* 2*d.* Under these conditions the more sugar the West Indian planter produced the greater was the loss he suffered.

"The conditions of production of beet sugar appear to have been in themselves scarcely more profitable. The total production of beet sugar for 1894 was estimated in round numbers at 5,000,000 tons, at a cost of 9*l.* a ton. The price realized for beet sugar was 8*l.* 15*s.* a ton, representing what would under ordinary conditions have been a total loss to the beet-sugar industry of 1,250,000*l.* But the annual sum paid in bounties by the foreign Governments under whose protection the beet-sugar industry is fostered, amounted for that year to 4,290,000*l.* If the

* The *Times* stated 60 per cent. But this was an obvious error.

figures are correct, the beet sugar industry, working at a commercial loss, received from the taxpayers of the countries in which it is located a sum which represented the very respectable profit of 3,040,000*l.* The bounty being paid at so much a ton, the beet-sugar grower has every incitement to continue to produce so long as what may be termed his political gain outbalances his commercial loss.

"Under such conditions of competition with regard to production the West Indian planter may be pardoned if he has his moments of something approaching to despair. His hope would have been that an unrestricted demand might keep pace with the artificially increased supply, and that thus prices would in due course recover their balance. Here, again, the Continental system is against him. In Great Britain, where there are no duties, the consumption per head of the population reaches 73 lbs. In France, where there is a duty of 24*l.* a ton, consumption falls to 28 lbs. per head of the population. In Germany is is 26 lbs. a head, in Austria it is 17 lbs. Thus, while the production is, on the one hand, stimulated by bounties, consumption is, on the other hand, restricted by duties. Supply is artificially increased, demand is artificially diminished, and the interference with economic law is complete.

"The situation as it is offers, however, certain elements of hope. In the first place, the burden of the bounties on the taxpayers of the Continent, becoming every year more weighty, tends by that very fact to bring about its own cure. At the present rates of bounty a crop such as that of last year involves an annual cost in round numbers of almost 5,000,000*l.* to the bounty-giving Governments. Every further fall in price further increases the burden, and a decrease of 1*l.* per ton in the market price would mean, at present rates of production, a further charge of 5,000,000*l.* The most patient taxpayers revolt when such charges for the benefit of one industry are piled too indiscriminately upon their budget, and there are signs that the bounty system of Continental nations cannot last for ever. Again, although in presence of the consumption of 73 lbs. per head of sugar by the population of Great Britain the restrictions placed upon the consumption of the Continent may present a source of somewhat bitter reflection to the sugar grower, there is comfort in the reflection that the powers of consumption of the world's markets have by no means reached their limits, and that, if by any change of policy the duties should at some future time be diminished, the demand might readily be doubled. If by the removal of bounties production were reduced to its natural level, and by the removal of duties demand were allowed to reach its natural limits, there would be room for growers of both cane and beet, and all might yet be well with the sugar industry.

"The pressing question for the West Indian sugar growers is how to hold out till this favourable change shall take place. Representations of the necessity for action of some kind have poured in upon the Imperial Government, in the form chiefly of petitions for relief, from the principal sugar colonies, and it is perhaps not altogether unnatural that, foremost among the proposals of the suffering planter, is the request that his production of sugar also might be supported at the cost of the taxpayers by a system of English bounty and the imposition of countervailing duties at English ports. He is so urgently in need of money that any means by which it may be obtained would be acceptable to him.

"That men seeing themselves on the verge of grave disaster should be willing to snatch at any means in their power to avert the peril is

comprehensible, but that any radical improvements in the conditions of the industry could be brought about by a further stimulus to supply accompanied by a further restriction of demand is a view which will hardly be accepted by the disinterested observer. To grant this form of relief would be to prolong indefinitely a position which can only lead to further mischief and extend the area of inevitable industrial disaster. Other means than these must be found to enable the West Indian industry to live through the present period of depression.

"It must not be forgotten that at this moment there is a portion of the Empire in which the cane sugar industry, suffering as it necessarily has done from the late fall in prices, is nevertheless in a condition of prosperity, not only holding its position in the teeth of adverse fortune, but expanding and strengthening its position. The Queensland sugar industry has gone through its dark hours. The old system of large plantations has been pronounced a failure. A large proportion of the planters engaged in the industry were ruined. The industry has been forced to undergo a searching and painful process of re-organisation. But, under the new system of small plantations and large central mills, it is not only bringing in a fair return for the capital invested in the sugar factories, but it has been instrumental in settling a prosperous class of small farmers and peasant proprietors upon the soil.

"In connexion with the possibilities of reorganisation it is sufficient for the moment to indicate one point. In evidence given before the Commission held in British Guiana it was stated that a ton of sugar cost almost 14*l.* to produce, and that one-half of the cost—that is, 7*l.*—might be put down to labour. It has also been estimated that a well-equipped estate in British Guiana, producing about 3,000 tons of sugar, will employ about 1,500 labourers besides mechanics and a management staff. Under the new system of organisation in Queensland an estate of similar capacity, producing about 3,000 tons of sugar, will employ about 212 whites, including mechanics, and 420 coloured labourers, giving a total of 632 hands. Throughout the plantations it has been found that the new system of small proprietors has had for one of its effects the general reduction of the labour bill by one-half. Apply this rule to the ton of West Indian sugar, of which it was stated that the cost in labour of production was 7*l.*, and a saving of 3*l.* 5*s.* per ton would at once be effected. Three pounds five shillings saved in cost of production would be more valuable than any bounty which is at present paid by Continental nations, and, if the remedy be applicable, would alone suffice to save the West Indian sugar industry.

"To assume that the conditions are exactly similar and that any exact parallel can be drawn would be unjust until the conditions have been more fully inquired into. The argument indicates only possibilities which may exist, and may, for causes unknown to us, have been overlooked. A commission of competent investigators able thoroughly to examine the whole position need not begin their labours without hope of arriving at some practical solution of the difficulties with which the sugar industry is confronted, and if it should be found possible to include in the commission some members having knowledge of the conditions of the sugar industry in Queensland the chances of success will be materially increased."

DXLVI.—PRICES OF HOME-GROWN TIMBER for 1896.

The following article reprinted from the *Gardeners' Chronicle* of January 2, of the present year, is a useful summary of the prices of home-grown timber during the preceding one. The subject is one of frequent inquiry.

During the year 1896 "the prices of home-grown timber and forest produce generally, cannot be said to have greatly improved. Certainly, the demand for almost every class of timber has increased appreciably during the last three months, and for certain kinds it may truthfully be said that the demand greatly exceeds the supply. This is especially true with oak, ash, and larch of good quality and large size, these meeting with a ready sale at fair prices. Large clean oak fetches from 1*s.* 8*d.* to fully 2*s.* per foot, and several small parcels of special quality changed hands of late at prices even in excess of any just named. Ash, too, finds a ready market at 1*s.* 8*d.* per foot, and that of extra good quality was sold at an auction lately for 2*s.* per foot. Of course, the difference between clean grown plantation trees, and those from the field and hedgerow is apparent to everyone interested in the conversion of our home-grown woods, and the purchaser pays accordingly. Elm is still a drug in the market, and plenty, of perhaps not the best quality, can be got at the low figure of 6*d.* a foot, and a large batch of roughish trees recently was sold for 4*d.* a foot. Large and sound sycamore finds a ready market at highly remunerative prices, and I recently sold a number of first-class trees at 2*s.* 6*d.* per foot, but from 1*s.* 8*d.* to 2*s.* is nearer the mark generally.

"Then, 'maiden' willow, if fit for bat-making, finds a quick sale at high prices, and here again the supply falls far short of the demand. Beech, such as that produced on the Chiltern Hills, and in certain parts of Kent, Surrey, and Hertfordshire, sells readily at fully 1*s.* per foot, though 8*d.* is the average price in most parts of the country. The demand for this class of timber is very good at present; but rough, knotty small stuff can hardly be sold at even firewood price.

"Both alder and birch fetch 10*d.* per foot, especially in districts where the making of clog-soles is a part of the industry.

"Larch sells perhaps more readily than any other of our home-grown timbers, the quantity of this on hand at the present time being small indeed. From 1*s.* to 1*s.* 3*d.* may be considered fair for that of good quality. Scotch fir, on the other hand, is hard to get rid of even at the low figure of 6*d.* per foot, and there are lots at present offered below that price.

"Oak-bark is gradually deteriorating in value, and about 3*l.* 12*s.* was paid for large quantities during the past season. When we count 30*s.* per ton for barking and harvesting, and a further few shillings for delivery and supervision, the profits attending such a precarious commodity as oak-bark, even in an ordinary season, are hardly commensurate with the risks involved. Large faggots used to sell readily at 22*s.* per 100, but plenty are waiting to be sold at 12*s.* in the London market. Small faggots for fire lighting—"pimps" they are called in southern England—can now be bought in the city at 2*s.* 6*d.* per 100—a contrast to the 4*s.* 6*d.* readily got not so many years ago. The split batten ends, now offered for sale by almost every grocer, have quite ousted the faggot from the market.

"Coppice-wood, too, does not fetch one half of what it did twenty years ago; that of sixteen years' growth, and composed mainly of ash and hazel, selling at the present time at from 5*l.* to 6*l.* per acre.

"It is confidently to be hoped that the rather brisker trade and better prices of home-grown timber and other forest produce during the past three months will fully maintained, if not increased, during the year 1897.—*A. D. Webster.*"

DXLVII.—MYRRH.

In the *Kew Bulletin* for 1896 (pp. 86–91) an attempt was made to settle the botanical origin of myrrh. The publication of this paper has led to some fresh investigations by Dr. Schweinfurth and Mr. E. M. Holmes, Curator of the Museum of the Pharmaceutical Society. These made some further discussion of the subject necessary.

1. *Balsamodendron Myrrha* was described by Nees from Ehrenberg's specimens. They were sent from Berlin for Dr. Trimen's examination. He remarks (*Medicinal Plants*, sub. t. 60) "the whole available material is quite insufficient to enable a sound opinion to be formed as to whether *B. Myrrha* is a distinct species."

Dr. Schweinfurth has very kindly sent to Kew an analysis of the single fruit accompanying Ehrenberg's specimens, and presumably belonging to them. This indicates the validity of the species satisfactorily. It further leaves no doubt that the plant collected by Schweinfurth in the Yemen district may be referred with certainty to this species.

2. The fragmentary specimen collected by Captain Hunter at Aden, and labelled by him "true Myrrh," also probably belongs to it (*Kew Bulletin*, 1896, p. 90).

3. Mr. Holmes has cultivated in a remarkable manner the appreciation of distinctions of taste as a means of testing the identity of plants. Such an acquirement is simply invaluable in pharmacological investigation. Using this criterion he has discussed the subject in the *Pharmaceutical Journal* (Dec. 12, 1896, pp. 507, 508). He points out that true myrrh has a very bitter taste and a peculiar aroma, hardly likely to be absent in the plant itself. This bitter taste he finds:—(i) in Schweinfurth's specimens of *B. Myrrha* from Yemen; (ii) in Captain Hunter's specimens from Aden; (iii) in Mr. Wykeham Perry's specimen from the Fadhli district which Trimen (*l.c.*) identified with *B. Myrrha*, but which was referred in the *Kew Bulletin* (l.c. p. 90) to *B.* (Commiphora) *simplicifolium*, having been previously ("Kew Report," 1878, p. 40) conjectured to belong to *B. Opobalsamum*.

4. The evidence taken together seems to be sufficient to allow us to regard all three plants as belonging to the same species, and as affording Arabian Myrrh. The objections are:—(i) that Fadhli myrrh is said to give a violet colour with bromine, which Yemen myrrh does not; (ii) that *B. Myrrha*, according to Schweinfurth, is completely inodorous, and does not produce any resin. Mr. Holmes meets the latter difficulty by suggesting that Schweinfurth has been misled as to the plant. There may also have been easily some confusion as to its botanical identity. Professor Engler has in fact mixed up with *Balsamodendron Myrrha*, *B. Playfairii*, which certainly does not produce true myrrh.

5. As to Somali myrrh, Schweinfurth has again kindly furnished an analysis of the identical specimen collected by Hildebrandt, and figured by Trimen in *Medicinal Plants*, t. 60. Engler and Schweinfurth identify it with *Balsamodendron Playfairii*, the source of Gum Hotai. In this they are certainly mistaken. As stated in the *Kew Bulletin* (*l.c.*, 87):—"It is apparently closely allied to *Balsamodendron* (Commiphora) *Schimperi*." Holmes objects that this has a turpentiny but not a bitter taste. Schweinfurth, however, regards *B. Schimperi* (*Kew Bulletin*, 1896, p. 89) as one of the sources of Arabian myrrh. In any case the origin of Somali myrrh cannot be said to be satisfactorily cleared up. As the country is now often visited by travellers it is much to be desired that the plant really yielding its myrrh may be conclusively determined by the collection and examination of adequate specimens.

6. In the *Kew Bulletin* (*l.c.* p. 91) it was suggested that *B. simplicifolium* may be accepted as the source of Yemen myrrh. It since appears that under the names *Commiphora simplicifolia*, Schweinfurth inadvertently distributed two species:—*B. Schimperi* and *B. simplicifolium*; the latter is now reduced by him to a variety of *B. abyssinicum*. He remarks in a letter that "the simple leaves are only due to the season and to the short branches; the same thing happens with the Abyssinian *C. abyssinica*" according to Deflers, cited in the *Kew Bulletin* (l.c. p. 90), this species yields myrrh both in the Fadhli and Yemen districts. Schweinfurth, however, adds in the letter with which he has kindly furnished me:—"Fadhli myrrh is partly yielded by *C. abyssinica* as proved by M. Deflers; but *all* Fadhli myrrh may not be yielded by it. We cannot accept this plant as its only source. I did not visit the districts where myrrh is collected in Yemen; this was to the north of the region explored by myself. M. Deflers did visit it, but he did not collect specimens of the myrrh plant *there*."

7. Whether *B. abyssinicum* is really a source of myrrh is not of very great importance as, thanks to Mr. Holmes, we seem to be on safe ground in accepting its old attribution to *B. Myrrha*.

W. T. T. D.

DXLVIII.—BOTANICAL EXPLORATION IN YUNNAN.

Dr. Henry, the well-known Chinese botanist, is now stationed in Yunnan. The following extract from a letter recently received from him gives some interesting particulars of this botanically rich region:—

Customs, Mengtse, par Laokay, Tonking.
Sept. 5, 1896.

"As regards botany, *e.g.*, this region—on the outskirts of which I was stationed at Ichang, and now am here again on another border of it at Mengtse—is, I imagine, the most interesting in the world. It is evidently the headquarters of most of the genera which are now spread all over Europe and Asia in great part. The geology is quite unknown and it is a combination of knowledge of the ancient history of the region geologically, and of the flora, which will explain much that is obscure in the present distribution of species. I have told you of the immense, universal and peculiar deposit of red clay which covers Yunnan, extending into the Shan States. This perhaps speaks of glaciation and perhaps it is to glacial phenomena that the present richness of the flora is due.

"I intend to go on collecting vigorously, and hope to rival Delavay in Yunnan. His 3000 species will be hard to beat.

"The country immediately around Mengtse is not so very rich, as it bare of wood and water: but in all directions at two to four days' distance there is splendid country. I have just had a native collecting in the mountains south of the Red River near the French frontier, and he has brought back from the virgin forests of a high mountain about 100 interesting species, *e.g.*, he has re-found *Tetracentron* (a genus of *Trochodendriæ*) perhaps a new species, at any rate a variety, of the Hupeh plant. He has also brought me undoubted *wild tea*. Hitherto the tea plant has been found wild only in Assam, the cases of its spontaneity recorded from China being very doubtful. In all my trips in Szechwan and Hupeh I never met it. The present specimens are above suspicion, coming from virgin forest, and at an immense distance from any tea cultivation, the nearest being P'u-êrh 200 miles west. Bretschneider in *Botanicon Sinicum* part II., p. 130, has some remarks on the antiquity of tea in China, and it was not till the sixth or seventh century that it came into general use. It is probable that it was found wild in these southern provinces, which did not form a part of the ancient Chinese empire, and I daresay it will be found wild in these mountains from Mengtse to Szemao. It is not probable at all that tea came from so far away as Assam.

"My native also brought back some interesting ferns, pretty *Cyrtandreæ*, &c., and some specimens in fruit of the curious *Lysimachia*, the leaves of which have a delicate but strong fragrance. They are used for scenting hair-oil by the Chinese. Perhaps some of the seed is ripe enough for me to send to you for cultivation.

"I have had enquiries from a London firm about soap trees. They wish to buy the fruits of these in quantity, as they have brought out some patent or other, which demands a large consumption of these fruits. I presume the *saponin* therein is the base of the patent (for washing fine fabrics, hair-wash, &c., perhaps). They didn't say what their patent was.

"A large number of soap-trees occur in China, and I would write a note for the *Bulletin* on the subject, as it is of perhaps considerable commercial importance, but one thing is wanting. The species of *Gleditschia* require revision. Four are mentioned in the *Index Fl. Sin.*, I., p. 208 *et seq.*, but since then there is a new one from Hupeh and another from Yunnan. There were also specimens of mine at Kew from S. Formosa which are not yet matched with any described species.

"The chief soap-trees are *Sapindus Mukorossi*, *Gymnocladus sinensis*, and all the species of *Gleditschia*, except *G. officinalis*, Hemsley, which has a small pod only used as a drug. The fruits of these are very generally used in China in lieu of soap, and for washing the hair the Chinese ladies say they are superior to alkaline soaps.

"I have tried, in vain, to get a Lolo teacher to instruct me in the language and teach me their method of writing, now almost gone out of use, if not entirely. The MSS. of the Lolos are as yet undeciphered.

"I told you about the plague, its ravages amounting to actual decimation of the inhabitants of Mengtse town. It suddenly ceased on or about the 8th August, a few cases having appeared in the surrounding villages just before, and it is now gone completely from this neighbourhood, though I hear it is now prevalent in a town some 20 miles away on the other side of our mountains.

"My collector also found some *Laurineæ*, the absence of which was rather puzzling to me. I am sending him off in another direction in

a day or two. The mountains he botanised over he described as lofty and covered with thick forest of immense trees. Bears occur there, a sure sign of virgin forest, as far as my experience goes in China.

"I have little more to add, as I have not been away lately on any interesting trips, I, however, find much to interest me in the mountains around: it is not everywhere you come across plants you have not seen before almost every day. The orchids are plentiful and rich in species.

"This place is isolated in the extreme, and it takes such a time to receive letters. As regards stores, they come after delays of months. I have nearly finished all my shoes, and there are new pairs I hope all along the way, but they do not seem to come.

"It is rather easy travelling about here, as mules are cheap and numerous. I have just had a tent made for trips. The savage villages in the mountains are too dirty to stay in, even if one always found these queer folk in the humour to take one in. What I mean by 'too dirty' is something awful, as I put up quite comfortably with the huts of the Chinese in Hupeh, which were comparatively clean.

"The Chinaman is of course superior to these Shans, Lolos, Miao-tzu, in energy and various other laudable qualities, but the Miao-tzu and true Lolos of the mountains have more pleasant manners in many ways, at least I like their looks and way of talking.

"Does no geologist ever dream of investigating these regions? Yunnan is well known for its mineral wealth. It is easy enough now getting here from Hongkong by way of Tonking."

DXLIX.—KINO FROM MYRISTICA MALABARICA.

An astringent, red, resinous substance obtained from the sap of various trees of tropical countries is known as Kino. The best medicinal kind which contains 75 per cent. of tannic acid comes from the Indian Kino tree *Pterocarpus Marsupium*, Roxb. while Bengal Kino is obtained in the form of round tears of an intense ruby colour from *Butea frondosa*. Kino is usually used in medicine for its astringent properties in cases of diarrhœa, chronic dysentery, &c.

Among the various specimens obtained for the museum of the Royal Gardens from the International Forestry Exhibition held in Edinburgh in 1884, was a peculiar dark resinous substance labelled "Kât jadikai" or Kino obtained from *Myristica malabarica*. It formed part of a collection of products made by Mr. Rhodes Morgan, District Forest Officer, Malabar.

In appearance the substance is very much like that obtained from *Pterocarpus Marsupium*. It has since been examined by Professor Edward Schaer, of Strasburg, who has communicated an interesting account of it to the *Pharmaceutical Journal* (4th series, Vol. III. p. 117), from which the following extracts are taken :—

"Professor Warburg, of Berlin, has kindly forwarded to me a sample of an extract or secretion resembling official Kino which with well known liberality had been put at his disposal by the director of the Royal Gardens, Kew. The sample in question labelled 'Kât jadikai,' that is to say cutch-like product of jadikai (Tamil name for *Myristica*), and known to be produced by incisions in the bark of *Myristica malabarica*, Lam., in Southern India, showed in its exterior appearance more direct analogy to the well-known Malabar Kino than to the 'Kâts' of *Acacia* (Cutch) or of *Uncaria* (Gambier). It consisted like officinal

Kino of smaller or larger angular transparent pieces of a deep garnet colour in thin fragments. It was not altogether unlike small broken dragon's-blood in some respects, and the latter name has been used sometimes by natives and merchants for some kinds of kino (from *Pterocarpus indicus* and *P. erinaceus*).

"Not having been acquainted before that time with kino-like products from the genus *Myristica*, and following the suggestion of Professor Warburg, who was then preparing a monograph of the Myristicaceæ, I at once proceeded to a closer examination of the new substance, availing myself of the latest observations concerning the natural history of the different kinds of kino, especially of the drug derived from *Pterocarpus Marsupium* (Malabar kino). Not only on its external appearance but also in its behaviour to water and other solvents, the 'Kât jadikai' or kino from *Myristica malabarica* agreed almost entirely with *Pterocarpus* kino, giving a reddish, slightly turbid solution of feebly but perceptibly acid reaction to litmus paper. The other physical qualities, for the most part proved to be the same at those described by Hanbury and Fluckiger (*Pharmacographia* II. Ed. 1879, p. 195). The same may also be stated concerning the more important and characteristic chemical reactions when compared with the chemical behaviour of official kino."

Professor Schaer thus summarises the results of his investigations into this and some other kinds, the produce of species of *Myristica*.

I. The dried juices of the bark of several Asiatic species of *Myristica*, for instance, of *M. malabarica*, Lam., and *M. fragrans*, Houtt., as regards their appearance and physical qualities, show but little difference from the officinal Malabar Kino.

II. These substances, which may be termed Myristica Kinos, agree in the chemical reactions due to their constituents, in all important points, with the Kino of *Pterocarpus Marsupium*. It can therefore be stated that drugs of a very similar character, and partly of close resemblance to official kino, are to be found in the families of Leguminosæ (*Butea*, *Pterocarpus*, *Millettia*), Saxifragaceæ (*Ceratopetalum*), Myrtaceæ (*Eucalyptus*, *Angophora*), and Myristicaceæ.

III. The *Myristica* Kino differs, as far as can be observed from the *Pterocarpus* Kino, and probably also from *Butea* and *Eucalyptus* Kino, by containing, in the crude state of the inspissated fresh juice, smaller or larger amounts of a distinctly crystalline calcium salt, viz., calcium tartrate, suspended in, and depositing from, the liquid juice. By this characteristic admixture it can be easily distinguished from the official Kino, and probably also from other Kinos of commerce.

Whether this new substance might ever be obtained in combination with the production of nutmegs and mace, so as to play the part of a commercial drug, will depend upon a still better knowledge of its qualities, its formation in the living plant, its quantitive relations, and similar questions.

DL.—CULTIVATION OF COTTON IN EGYPT.

(*Gossypium barbadense*, L.)

Next to the United States and India, Egypt is one of the important cotton-producing countries of the world. The quantity of Egyptian cotton received in this country is about 2,000,000 cwts. annually. The

quality is usually exceptionally good, and ranks next to the celebrated Sea-island cotton of America.

The following sketch of the history of cotton cultivation in Egypt lately appeared in *Journal of the Society of Arts* (December 25th, 1896, pp. 98, 99).

"Some interesting information is given in a recent issue of the *Bulletin du Ministère de l'Agriculture* respecting the different descriptions of cotton which have been successively cultivated in Egypt. The first cotton cultivated in the delta of the Nile was called *Jumel*, after the name of the person who introduced its cultivation, in the reign of Mehemet Ali, in 1820. M. Jumel, who was a Frenchman, had remarked in the garden of one of his friends living near Cairo, certain cotton plants, of which the seed had been imported from the Soudan. He succeeded in cultivating the plant from seeds which he obtained, and presented certain of them to Mehemet Ali, who, foreseeing the sources of wealth that the cotton might assure to the country, placed at the disposal of Jumel vast extents of territory, and gave him every facility in his enterprise. This cotton was also known by the name of *Mako*, after a bey in whose gardens Jumel had originally found the first seeds. *Jumel*, or *Mako*, was for many years the only cotton cultivated, but for a time it was replaced by a new variety called *Ashmouni*. This *Ashmouni* degenerated after 20 years of cultivation, and was abandoned for *Mit Afifi*, which at the present time is most largely cultivated in Egypt. *Mit Afifi* is a very strong variety of cotton, easy to grow, and does not require any very excessive irrigation. The colour is slightly yellow and is much appreciated by spinners. Another kind of cotton called *Bahmieh** is grown to a limited extent, and this is a delicate variety requiring a stronger soil. It yields a whitish cotton, which is particularly used for certain articles of hosiery. It enjoys a great reputation in the United States, while France and Germany consume small quantities of it. The cultivation of the varieties called "white cotton" has very considerably fallen off. Their total annual production hardly exceeds from 60,000 to 70,000 quintals. Many other varieties, such as *Zafivi*, *Abbassi*, &c., have been experimented with by many growers, but up to the present the results have not been sufficiently advanced to enable an accurate opinion to be formed as to their merits. Egyptian cotton, whatever its variety, preserves its essential qualities, which causes it to be much sought after by European and American manufacturers. As a matter of fact, no cotton, with the exception perhaps of Sea Island, the production of which is to some extent restricted, and the price too high to admit of its general and universal consumption, has the fineness, the strength, and the brilliancy necessary for the manufacture under good conditions of a large number of special articles. Egyptian cottons are used in making threads of the numbers 60 to 150, while Indian cotton makes threads of numbers 5 to 18, and American cotton threads from 20 to 50. The qualities of Egyptian cotton are such that it finds a ready outlet on European markets, no matter what may be the production and prices of cotton of other origins."

The following further information respecting Egyptian cotton is taken from the *Journal of the Royal Agricultural Society*, vii. 627, and contains notes on the use of manures for increasing cotton crops in the Nile Valley:

"It is to the cotton crop of the Delta that Egypt owes its present financial prosperity. It covers between a third and a half of the area,

* An account of Bahmieh or Bamia Cotton is given in the Kew Report for 1877, pp. 26, 27.

the remainder being uncropped in the summer, but cropped with maize in flood-time. During the winter the country is an uninterrupted expanse of wheat, barley, and clover. The cotton is sown in March, and is on the ground till the end of October, receiving about 14 waterings, of which nine are given during the hot weather by lift with bullock-wheel or steam-pump. Its produce is at least eight times that of Indian cotton, giving an average of about 500 lb. of lint per acre. Clover or wheat follows.

"The clover is sown amongst the cotton plants before they are cut, and gives five cuttings between November and June, requiring eight waterings. Maize follows during the flood, and, after the maize, wheat. During the next flood maize is again sown, and is followed by clover, which, after two cuttings, is ploughed up to make way for cotton. Thus, in three years the cultivator gets a crop of cotton, two crops of maize, a crop of wheat, and seven cuttings of clover. In some places cotton is grown every other year, the intermediate crops being wheat, maize, and clover. On the large estate which formed the 'Domains' of Ismail Pasha, and is now managed by a board on behalf of his creditors, the maize cropping is generally omitted, and the land is given two fallows in flood-time in the course of three years. Maize is almost invariably manured. Cotton follows clover and is commonly unmanured. But the Domains administration has found that, by the use of manure, at least 200 lb. can be added to the produce per acre, and the practice of top-dressing is spreading. It may be safely concluded that two-thirds of the Delta—or one and three-quarters million acres—receive manure annually."

DLI.—PAPAIN.

(*Carica Papaya, L.*)

The papaw tree is one of the commonest objects in tropical countries. The fruit cultivated is pear- or almond-shaped, 7–15 in. long, yellow when ripe, and often eaten as a delicacy. The milky juice is well known to render meat tender, and even the leaves are sometimes used for that purpose. This milky juice contains a ferment which has a solvent action upon albuminoid substances, and, like pepsin, curdles milk. It is, however, not so active as pepsin.

Inquiry has been made as to the preparation of papain for commerce in our tropical possessions. The demand is, however, extremely small. A small factory already exists in the island of Montserrat, as recorded in the *Kew Bulletin* (1891, p. 120), the output of which, with an increased demand, would doubtless be much increased.

In a recent article in the *Agricultural Ledger*, 1896, No. 31 (Medical and Chemical Series), issued by the Reporter on Economic Products to the Government of India, the following particulars are given respecting the properties and preparation of papain in India:—

Report on Dried Juice of *Carica Papaya* from Gondal, Kathiawar, by Mr. John C. Umney, with a Review of the Recent Literature on the Subject, by D. Hooper, F.C.S.

The *Carica Papaya* tree is so well known and established in India that it seems desirable to set forth what authentic information we

possess on the remarkable properties of the plant. A vast amount has recently been written on the action of the "vegetable pepsin" contained in the juice that abounds in the unripe fruit.

The digestive action of the juice upon meat was probably known in the West Indies at a very early date, and appears to have been communicated to the inhabitants of this country upon the introduction of the tree by the Portuguese, as it has long been the custom in India to render meat tender by rubbing it with the juice of the fruit or by wrapping it in the leaves. In the old "*History of Barbados*" by Griffith Hughes, the author quaintly informs us that "this juice is of so penetrating a nature that if the unripe peeled fruit be boiled with the toughest old salted meat, it quickly makes it soft and tender; and if pigs be fed with the fruit, especially unripe, the thin mucous matter which coats the inside of the intestine is attacked, and, if the food be unchanged, is completely destroyed." The author of the *Makhzan-el-adwiya* (1770) described the tree in his day, and mentions the use of the juice mixed with ginger, for making meat tender.

In 1877, the milky juice of the *Carica* began to attract attention in Europe as a digestive ferment, and Herr Wittmack, of Berlin, in 1878 made a careful examination of its properties and came to the following conclusions respecting it :—

(1) The milky juice of the *Carica Papaya* is (or contains) a ferment which has an extraordinarily energetic action upon nitrogenous substances, and like pepsin curdles milk; (2) this juice differs from pepsin in being active without the addition of free acid, probably it contains a small quantity, and further it operates at a higher temperature (about 60° to 65° C.) and in a shorter time (5 minutes at most); (3) the filtered juice differs chemically from pepsin in that it gives no precipitate on boiling and further that it is precipitated by mercuric chloride, iodine, and all the mineral acids; (4) it resembles pepsin in being precipitated by neutral acetate of lead, and not giving a precipitate with sulphate of copper and perchloride of iron (*Pharm. Journ.*, Nov. 30th 1878).

Dr. Geissler, experimenting in the same direction, found that papain could dissolve 28 times its weight of coagulated albumen, while pepsin dissolved 100 times its own weight.

In 1879 Dr. Theodor Peckolt, of Brazil, made a very complete analysis of the fruit, leaves and seeds of *Carica Papaya*, and he found papayotin in nearly every part of the fresh plant, besides other organic constituents which he separated and estimated.

Dr. Sidney Martin of London was the next to investigate the peculiar principle of the fruit. He showed in 1886 (*Journal of Physiology*) that papain was a proteolytic ferment which acts very similarly to trypsin. Experiments performed with meat fibrin and white of egg showed that slight digestion takes place when the liquid is faintly acid, but none at all when decidedly acid. Digestion takes place actively in neutral or alkaline solutions, and occurs most readily at a temperature between 35° and 40° Fahr. The results of the digestion are peptones, leucine, and tyrosine, and an intermediate globulin-like substance similar to that formed in pancreatic digestion.

In the author's second paper on the same subject the ferment in papaw juice is shown to be associated with an albumose, and to give the following reactions in addition to those previously described by Wurtz :—The solution gives a biuret reaction, and it is precipitated from a neutral solution of sodium, magnesium sulphate or sodium chloride alone, as globulins are. It is soluble in glycerol, and if precipitated

from this solution by alcohol, the filtrate has no proteolytic power. The kind of albumose is one nearly akin to the protalbumose of Kühne and Chittenden, and is called α-phytalbumose. Papaw juice also contains a milk-curdling ferment. The proteids present in papaw juice were found to be as follows :—

(1.) Globulin, resembling serum globulin in its most important properties.

(2.) Albumin.

(3.) β-phytalbumose precipitated almost completely by heat, by saturation with neutral salts, but not by dialysis. It differs from the heteroalbumose of Kühne and Chittenden, by not being precipitated by dialysis, by copper sulphate, or by mercuric chloride.

(4.) α-phytalbumose; soluble in cold or boiling water; not precipitated by saturation with neutral salts, except in an acid solution. This is the vegetable peptone referred to by Vines (*Journ. Physiol*, iii.) as hemialbumose. It differs from the protalbumose of Kühne and Chittenden by its non-precipitation by sodium chloride or by copper sulphate. Both these albumoses give the biuret reaction.

No peptones occur in the juice, but leucine and tyrosine are present. By a series of digestion experiments carried out on each of these proteids by papain in a neutral liquid, it was found that both the globulin and albumen are changed into β-phytalbumose, and that this becomes a peptone-like substance, and forms leucine and tyrosine. The α-phytalbumose becomes a similar peptone-like substance, leucine and tyrosine being formed. This peptone-like substance, resembles the deuteroalbumose of Kühne and Chittenden, except that a solution of it when rendered acid by acetic acid in the presence of sodium chloride, does not become cloudy on warning. No true peptones are formed. Probably digestion in the plant itself is very slow, as much more liquid was used in the experiments than is present in the juice. The albumose forms probably the circulating proteid in the plant.

The leaves of the *Carica* which are said to make meat tender when they are wrapped round it for some time, were discovered by Dr. Greshoff in 1891 to possess an alkaloid named carpaine. Dr. Van Rijn further investigated the alkaloid in 1893, but did not attribute to it any digestive property. The quantity of carpaine separated from the leaves was 0·25 per cent.

On the evidence of the medical, physiological, and chemical experiments made upon *C. Papaya* the active principle has been separated and given the name of papain or papayotin. It is now an article of commerce in Europe for medical purposes; it has been extensively used in France and Germany, and has been given with good results even to children.

Notwithstanding all the experiments on the vegetable ferment in question, it seems not to have been received with confidence by the medical profession in England, and it has not been introduced into the Pharmacopœias as a substitute for pepsin. The statement often made that papain dissolves 200 times its own weight of fibrin has been contradicted on more than one occasion, and on the other hand it has been shown that papain compares very unfavourably with pepsin when tested with egg albumen under similar conditions.

Regarding this aspect of the case two important papers have recently been written. Dr. S. Rideal of St. George's Hospital, London (*Pharm. Journ.*, August 1894) endeavoured to make out a good case for papain, and attributed unfavourable results to the mistake of supposing that

papain should be tested under the same conditions that hold good for pepsin. Dr. Rideal noticed that papain differs from pepsin in so far as the former acts fairly well in an alkaline solution, while the latter does not, and more particularly that the proportion of fluid to albumen must be much less in the case of papain than is required with pepsin. Mr. D. B. Dott, F.I.C., in the moro recent article (*Pharm. Journ.*, March 7, 1896) records some experiments from which he adduced the following conclusions :—

1. That dried papain juice, and the papain prepared from it by purification and precipitation have very little solvent action on albumen, either in alkaline or acid solution.

2. That commercial papain has not nearly the solvent action on albumen which is possessed by pepsin, although it has a disintegrating and special action of its own on animal tissues.

During the course of Mr. Dott's investigations the presence of pepsin was suspected in one of the samples of commercial papain.

The next question that seems desirable to settle is the preparation of commercial papain. If, as it has been suggested, the papain is liable to sophistication with pespin or other subtances, it is impossible to arrive at any satisfactory results with regard to its digestive action. Then, again, the preparation in this country of the juice for the market has not perhaps received a sufficient amount of attention. It should be known that the juice in every case must be collected from *unripe* fruits. As prolonged moisture is deleterious to the ferment, the juice should be dried as soon as possible, and, as heat will destroy its activity, it should be dried at a low temperature. The best method to prepare papain is to collect the juice of the unripe fruit, mix the juice with twice its own volume of rectified spirit, let the mixture stand for a few hours, and then filter off the insoluble matter, and dry it at the ordinary temperature of the atmosphere. After being powdered it should be kept in well-stoppered bottles ready for use.

The following notes on the collection of specimens of papain in India by the Reporter on Economic Products and the results of their examination in London will be read with interest. They show what varied activity the samples may possess if not carefully collected and preserved. If a trade in this substance is to be expected either in India or in Europe we would impress upon all manufacturers to observe carefully the precautions just enumerated. On account of caste difficulties, it would be impossible to introduce pepsin very largely into use in this country, but where a vegetable substance is available every effort should be made to increase our knowledge of it and to understand its action and methods of manufacture and administration.

In May 1894, Mr. M. J. Bharwada, Agricultural Assistant, Gondal, Kathiawar, forwarded to the reporter on economic products three samples of papain obtained from the juice of the fruit of the Papaw tree. These were (1) the precipitate from the milky juice made by adding pure alcohol; (2) the precipitate from the same juice by addition of rectified spirit; and (3) the dried and powdered juice. The specimens were forwarded to Mr. E. M. Holmes, Curator of Museum of the Pharmaceutical Society, who was asked to have them tested and reported upon with reference to their comparative value as substitute for pepsine. Mr. Ernest J. Easters, F.I.C., was kind enough to examine them, but he stated that they arrived in such a bad condition that not one of the samples was found to have any disturbing action on milk; the curdling of milk is a very characteristic property of the ferment of papaya juice.

Subsequently Mr. Bharwada made a second collection of products of *Carica* for examination, consisting of 12 ounces of the dried powder obtained from the juice, and a small quantity of papain prepared with alcohol. These were forwarded to the Curator of the Pharmaceutical Society who kindly placed them in the hands of Mr. J. C. Umney, F.C.S., for investigation. From Mr. Umney's experiments it would seem that a highly active ferment might be manufactured from the crude juice by repeated purification by alcohol. The attention of all those who are interested in the subject should be drawn to this method of preparation.

REPORT on a Sample of Powder of the Dried Juice of *Carica Papaya*, from Gondal, Kathiawar.

The sample was in coarse powder, of a greyish yellow colour, and possessed a faint, somewhat unpleasant odour.

Ten grammes dissolved in water and precipitated by absolute alcohol yielded 4·2 grammes of crude Papain, after drying at ordinary temperature over sulphuric acid.

The digestive power of this purified product was then tested on moist egg albumen, at a temperature of 38° — 39° C. in neutral acid and alkaline solutions using the following proportions :—

10	grammes	of egg albumen.
0·1	„	papain.
30	c.c.	Distilled water.
0·1	grammes	Bicarbonate of Sodium for Alkaline.
1	c.c.	Hydrochloric acid B.P. for acid.

Digested in 30 minutes.

Neutral - -	12·03 per cent.
Alkaline - -	13·72 „
Acid - -	12·07 „

These results indicate that the digestive activity in neutral and acid solutions is almost identical, whilst in alkaline solutions it is somewhat greater.

These results were compared with a well-known commercial Papain, proceeding on exactly similar lines, the results obtained being as under :—

Digested in 30 minutes.

Neutral - - -	17·81.
Alkaline - - -	17·483.
Acid - - -	25·0.

The greater activity in acid than neutral and alkaline solution is the principal point of difference between this brand of Papain and other commercial samples of papains and concentrated papaw juice, and has been the subject of controversy between different experimenters. The presence of another ferment, such as pepsin, active in acid solution, appears to be indicated.

I have examined several samples of commercial papains, and the results have been similar in every respect, and it may be noted that they accord well with those obtained by Dott (*P. J.*, 3rd Series, xxiv., 758, 759).

There is no doubt that by repeated precipitation by alcohol a highly active digestive product might be obtained from this crude concentrated papaw juice valuable for use under those circumstances where pepsin is unavailable.

JOHN C. UMNEY.

DLII.—MISCELLANEOUS NOTES.

Mr. Gwynne Vaughan, who had for the previous two years been working in the Jodrell Laboratory of the Royal Gardens, has been appointed an Assistant to the Regius Professor of Botany in the University of Glasgow.

Mr. W. H. Lang, Lecturer in Botany, Queen Margaret College, has been engaged during last year at the Jodrell Laboratory of the Royal Gardens in an investigation into the relation existing between variability in the fern plant and apogamy in the prothallus. This led to the interesting discovery of the occasional occurrence of sporangia on the latter. The results were communicated to the Royal Society, and published in the *Proceedings* for November last (Vol. 60, pp. 250–260).

West India Commission.—In consequence of the depressed condition of the West India Colonies a Royal Commission has recently been appointed, as published in the following announcement:—

The Queen has been pleased to appoint General Sir Henry Wylie Norman, G.C.B., G.C.M.G., C.I.E. (Chairman); Sir Edward Grey, Bart., M.P., and Sir David Barbour, K.C.S.I., to be Commissioners to inquire into the conditions and prospects of the West India sugar-growing Colonies, and Mr. Sidney Olivier, B.A., to be their Secretary; Daniel Morris, Esq., D.Sc., C.M.G., Assistant Director of the Royal Gardens, Kew, will accompany the Commission as Expert Adviser in botanical and agricultural questions.

The terms of the reference to the Commission were as follows :—

"To inquire into the condition and prospects of the colonies of Jamaica, British Guiana, Trinidad and Tobago, Barbados, Grenada, St. Vincent, St. Lucia, and the Leeward Islands, and of the sugar industry in those colonies, and of the labouring classes there, and especially whether the sugar industry is in danger of extinction in such colonies or any of them, and what is the amount of capital at present invested in it; whether the present depression is due wholly or in part to mismanagement, imperfect processes, absentee ownership, or any other causes independently of the competition of sugar produced under the bounty system, and whether the removal of such causes would be a sufficient remedy for the said depression. Whether in the event of the abandonment of sugar cultivation there are other industries which could be prosecuted with success, and which would find adequate employment for the population; and what would be the probable result of a complete failure of the sugar industry on the condition of the labouring classes, both West Indian and East Indian, and on the revenue of those Colonies, and whether any deficiency of revenue caused by the extinction of the sugar industry could be met by economies in the administration without imperial aid."

Botanical Magazine for January.—The plants figured are:—*Aristolochia clypeata*, *Cynoglossum nervosum*, *Berkheya Adlami*, *Croton Eluteria*, and *Bignonia buccinatoria*. The figure of the last-mentioned was prepared from a specimen received from the Commendatore Hanbury,

and of the others from plants in cultivation at Kew. The *Aristolochia*, native of New Grenada, is allied to *A. Duchartrei*, but the flowers are much larger. The Kew plants were received from Messrs. F. Sander & Co., of St. Alban's, in 1892. The *Cynoglossum*, the largest flowered of the Himalayan species, was raised from seeds sent to Kew by Mr. J. F. Duthie, in 1894. *Berkheya Adlami* is a new species from the Transvaal. R. W. Adlam, Esq., of Johannesberg, forwarded seeds to Kew in 1895, and these produced plants which flowered in June 1896. The *Croton* is of considerable commercial interest as the source of "Cascarilla Bark." The species, native of the Bahamas, was reintroduced into Europe in 1887, when three plants were sent to Kew by F. B. Taylor, Esq., of the Bahamas. *Bignonia buccinatoria*, from Central Mexico, has large, handsome flowers. It is figured in the Botanical Register as *B. Cherere*.

Botanical Magazine for February.—*Myrmecodia Antoinii*, *Maxillaria sanderiana*, *Ligustrum coriaceum*, *Paracaryum heliocarpum*, and *Hemipilia amethystina* are figured. The *Myrmecodia*, native of the islands of Torres Straits, is a singular rubiaceous plant, which has its stem very much enlarged at the base (see *Kew Bulletin*, 1897, p. 86). The flowers are insignificant. The plant figured was presented to Kew by Professor Stewart, F.R.S., and flowered in a stove in January 1896. *Maxillaria sanderiana* is probably the finest species of the genus. It is a native of Ecuador, where it grows at an altitude of 4,000 feet. The Japanese *Ligustrum* was drawn from a plant sent to Kew by Mr. Rashleigh, of Menabilly, in 1889. The *Paracaryum* is a West Himalayan species, which flowered in the Herbaceous Ground in May of last year, seeds having been sent to Kew by J. F. Duthie, Esq., F.L.S., Director of the Botanical Department of Northern India. The *Hemipilia* is a new species from Burma, and was sent to Kew by Messrs. W. L. Lewis & Co., of Southgate.

Supplement to the Index Kewensis.—It is satisfactory to be able to announce that M. Th. Durand and Mr. B. Daydon Jackson have made arrangements for printing their 10 years' supplement to the *Index Kewensis*, which will bring the work down to the end of the year 1895. It is hoped it may be issued during the present year.

Bambuseæ of British India.—The publication of Mr. Gamble's exhaustive monograph of the Bamboos of British India was announced in a previous number of the *Bulletin*. Sir Joseph Hooker has used it as the basis of his own revision of the Group in the Flora of British India. He has prefaced this with the following interesting note :—

"The following account of the Indian *Bambuseæ* is drawn up, almost verbatim, from Mr. Gamble's 'Bamboos of British India,' which forms part of vol. vii. of Dr. King's *Annals of the Royal Botanic Gardens of Calcutta*, and of which Dr. King favoured me with a copy in advance, together with his and Mr. Gamble's permission to reproduce its contents in a form suited to the 'Flora of British India.' In doing this I have been obliged to curtail the descriptions. And in order to preserve the arrangement of matter adopted in this work, I have had to substitute

for the Keys to the species employed by Mr. Gamble, specific characters selected according to my judgment from his detailed descriptions; and in a few cases to substitute synonymous technical terms for those he has used. I have added nothing; for it is obvious that a botanist of Mr. Gamble's ability and wide experience of so many of the Indian Bamboos in their native forests, having access also to the unrivalled collections in the Herbarium of the Calcutta Gardens, should have exhausted the subject in so far as materials were available. It must not be supposed that this work supersedes his 'Bamboos of British India,' which is indispensable to the student of the tribe, by reason of its fuller descriptions, and admirable plates and analyses. My cordial thanks are directly due to Dr. King and Mr. Gamble for this generous contribution the 'Flora of British India,' and indirectly for the authentically named collection of specimens corresponding to Mr. Gamble's descriptions, which has been presented by the Government of India to the Herbarium of the Royal Gardens, Kew.

"Since the above was written, Mr. Freeman Mitford's *The Bamboo Garden* has appeared, a work replete with valuable observations upon the habit, mode of growth, and other characters of the hardy species of Bamboo (including 5 Indian) cultivated by him. In it is pointed out (see *Arundinaria Simoni*, p. 60) for the first time the true characters of the two types of sheath and blade that occur in *Bambuseæ*, and which do not obtain, so far as I know, in any other tribe of grasses. In a communication which Mr. Mitford has been good enough to make to me on this subject he has formulated his views as follows, and has kindly allowed me to introduce them here.

"The sheath is an organ playing so important a part in the life of the bamboo that it deserves something more than a cursory notice. In the grasses generally the sheath is regarded by botanists as taking the place of the petiole of the leaf. It happens, however, that the leaves of most bamboos—indeed of all the hardy bamboos—have a distinct continuation of the midrib of the leaf attaching it to the sheath and articulated, which continuation might perhaps be correctly termed a petiolule. The bamboos, as it appears, bear sheaths of two types. There is first of all the series of sheaths which, borne one on each node and wrapped tightly round the culm or branch, as the case may be, protect it during growth. This form of sheath is divided or split transversely into two members, the ligule and the limbus or blade, the latter being what I would term a pseudophyll, or false leaf, sessile, lacking both midrib and petiole, varying in size in the different species, but always the first part to wither and disappear. In some bamboos—those of the *Phyllostachys* group—this sheath falls away as soon as branching takes place; in others, of the *Arundinaria* group, it remains, and having guarded the tender growth of the parent culm or branch it springs aside with the young branches or branchlets, devoting the remainder of its life to their protection until they can stand alone.

"Then there is the second form of sheath bearing a true leaf with petiole and midrib. This is the form assumed by the two, three, or four sheaths at the top of each culm branch and branchlet above the topmost node where branching ends. This true leaf is persistent upon the sheath. The ligule is present, as in the first type, but the deciduous pseudophyll is replaced by an evergreen leaf.

"An interesting question arises as to whether there is any transition stage between the two types of blade, or whether the change is always sudden. I think that in many Bamboos I can trace such a transition stage; that is to say, that each successive pseudophyll on the stem

becomes more and more like a true leaf, something of the nature of an arrested midrib being perceptible in the pseudophylls which are found near the top of the culm, though it is not until the last branching node has been passed that the true leaf-bearing sheaths occur. The principle remains inviolate (throughout the hardy species at any rate), and the distinction between the two classes of sheaths is absolutely maintained." —A. B. F. M.

"I would remark in conclusion that Mr. Mitford's observations, extending to the nervation of the leaves of Bamboos, lead him to the conclusion that of those cultivated by him in the open air in the middle of England, the truly hardy only have tessellated leaves; the tender, such as *Arundinaria Falconeri* and *falcata*, having very inconspicuous transverse nervules, or none."—J. D. H.

Insular Floras.—Amongst recent additions to the library bearing upon this subject the following are worthy of note. The *Flore de l'Ile de la Réunion*, by Dr. E. Jacob de Cordemoy, contains an account of the Phanerogams, Vascular Cryptogams, and Muscineæ of the island. The volume is prefaced by a short description of the island and its explorers. The cryptogams (excluding fungi) number 793, while the phanerogams amount to 1,156, of which 372 are monocotyledons. The order with most representatives is Orchideæ, with 172 species, including many curious novelties described by Mons. Ch. Frappier, specimens of some of which have been presented to the Herbarium by Dr. Cordemoy. Next to the Orchideæ in point of numbers come the Gramineæ with 94 species.

L'Archipel de la Nouvelle-Calédonie, by Dr. Aug. Bernard, contains a complete account of the islands of this group, including two chapters devoted to a general account of the vegetation, which is said to comprise 2,026 phanerogams and 965 cryptogams and to be the richest flora amongst those of the Pacific Archipelagos.

Flora de Juan Fernandez, by Dr. F. Johow, contains in addition to an enumeration of the plants, an account of the geographical and geological conditions of the archipelago.

New Guinea Plants.—Sir W. MacGregor, K.C.M.G., has presented a collection of plants made on Mount Scratchley, by Mr. A. Guilianetti, at altitudes varying from 4,000 to 13,000 feet. At the higher altitudes two species of *Vaccinium* and several of *Rhododendron* were met with. Eight undescribed species of grasses were collected. At lower elevations *Polygonum chinense*, L. and *Cordyline terminalis*, Kunth, were found, as well as *Solanum torvum*, Swtz., a species which has proved troublesome to agriculturalists in Assam (see *Kew Bulletin*, 1896, p. 63). A second collection, presented by Messrs. Veitch, was made by Mr. Burke between the coast and a height of 4,000 ft. on the Owen Stanley range in the south-east peninsula. The plants in this collection are of a tropical type and include a curious new species of *Begonia*.

Vanilla cultivation in the Seychelles.—In continuation of information that has already appeared in the *Kew Bulletin*, 1892, 111 (with plate), the following particulars have been communicated to this establishment by the Secretary of State for the Colonies :—

ADMINISTRATOR OF SEYCHELLES to COLONIAL OFFICE.

Government House, Seychelles,
SIR, September 25, 1896.

I HAVE the honour to report that the result of the Vanilla crop for this year is most satisfactory. The crop up to the present (it is not quite all gathered) is returned at 40,000 lbs., and has realised over half a million of rupees.

The prices have been exceptionally high owing, I am told, to a reduced exportation of Vanilla from Mexico. Seychelles Vanilla is now well and favourably known both in the London and Paris markets.

I have, &c.,
(Signed) H. COCKBURN STEWART,
Administrator.

To the Right Hon.
JOSEPH CHAMBERLAIN, M.P.,
&c. &c.

EXTRACT from Colonial Reports. Annual. No. 182. Seychelles. Annual Report for 1895, p. 9.

Next to cocoanut oil, Vanilla is our most important produce, and in a good year the crop gives a return of about Rs. 400,000. Unfortunately, vanilla is a most capricious plant, and, whereas we may have a good crop for two consecutive years, we may have also three, or even four, years without any crop at all.

Botanic Station, Old Calabar.—The following is an extract from a letter received from Mr. John Henry Holland, whose appointment as Assistant Curator of the Botanic Station in the Niger Coast Protectorate was announced in the *Kew Bulletin*, 1896, p. 147.

"The gardens are well situated, on rising ground, covering altogether about 45 acres. This includes a large area planted with coffee, a small proportion with cacao, whilst experimental grounds and nursery occupy the remaining part. There is, I can assure you, plenty to do.

"The quarters are good, situated conveniently in the gardens, on a hill about 160 feet high. We have not a very extensive view of the surrounding country, being partly enclosed with dense bush. We can, however, see Duke Town at the foot of the hill, and catch a glimpse of the river, with an occasional sight of a steamer passing by to the anchorage."

Spanish Chestnut.—The cultivation of the Spanish chestnut has now got beyond the experimental stage in Bashahr. Some of the trees planted 15 years ago are now 30 feet high and four feet in girth.

Fresh plants have been put out and others distributed to villagers. The present yield of nuts amounts to about 10 maunds. (*Progress Report of Forest Administration in the Punjab* for 1894–5, p. 14).

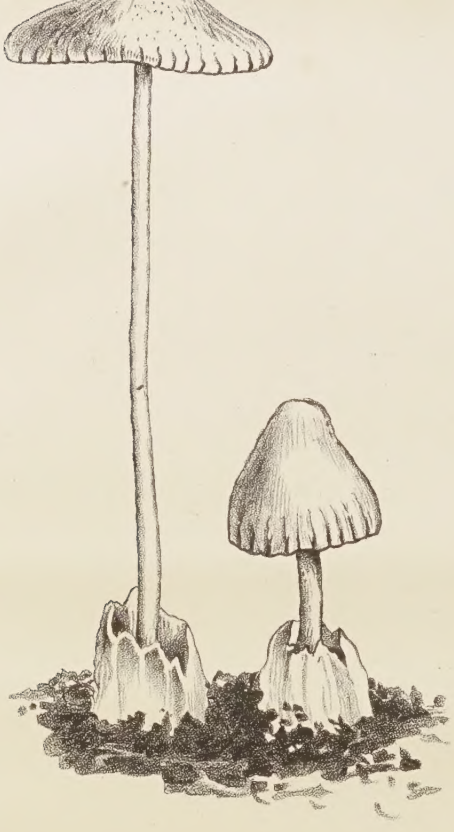
Kei-Apple as a Hedge Plant.—This shrubby South African plant (*Aberia Caffra*, Harv. & Sond.) a member of the Annatto Order (Bixineæ) is armed with long spines and makes excellent hedges. It is evergreen and bears fruits like small yellowish apples. When fresh they are acid and used as a pickle; when ripe they make a good jam. The *Waikato Times* of New Zealand, recommends the Kei-apple as a hedge plant in the following terms:—

"One is always hearing complaints nowadays of the paucity of good plants suitable for hedge purposes. This harbours the wheat rust or the leech, but dies out in patches, while another would be admirable were the cows not so fond of it. This being so, the thanks of the community are due to Mr. A. Tempest, of Parnell, for his enterprise in introducing and propagating the 'Kei Apple.' It was Sir George Grey, I believe, who first mentioned the shrub, which grows wild upon the Karoo, or sandy plains of South Africa, and it certainly seems a perfect hedge plant. It is a sturdy, stocky, short-jointed grower, an evergreen, and with thorns which grow to six inches long and over, and a 'perfect terror to evil doers,' be they beasts or human beings. As an added advantage, the female plants (they are of both sexes) fruit heavily, bearing in great quantity yellow plum-shaped fruit, the size of a green-gage, which are both pleasant eating and make an exquisite jam. Orchardists would do well to bear this shrub in mind when planting."

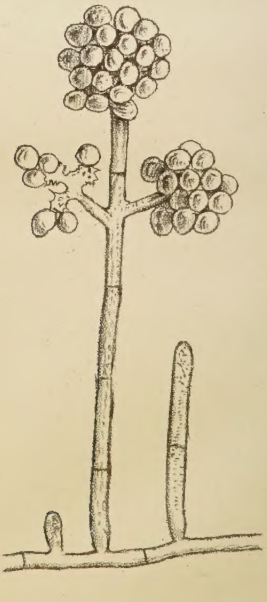
To this the following note is added in the *Agricultural Journal* of the Cape of Good Hope:—

"It will be noticed that a wrong part of the country is stated to be the native habitat of this plant, but all the good qualities as a hedge plant are perfectly true. In some old book of travels in South Africa it is stated that on the eastern coast there were 'wild apricots'; were these Kei apples? Few people like to eat the fruit raw, but the jam is first rate. A proportion of Kei apple with tomato would make a good jam."

Dr. J. R. Roth.—In consequence of a misreading of the name of the collector of a collection of plants made in Abyssinia and presented to Kew by the Honourable East India Company, and the consequent writing of this name—Rohr,—on all the labels accompanying the plants, some confusion has arisen. Several plants supposed to be named after the collector bear the spurious name. Dr. J. R. Roth was the real collector. He was attached as Naturalist to a mission sent by the British Government, in 1841, to Sáhela Selássie, the King of Shoa, in Southern Abyssinia. Mr. W. Cornwallis Harris, the author of the almost forgotten "Highlands of Æthiopia," was at the head of the mission, and in his book he speaks very highly of Dr. Roth, who contributed the appendix on the natural history of the country. Dr. Roth had previously travelled in Egypt, Arabia, and Syria, with Drs. Schubert and Erdl. Subsequently he became Professor of Natural History at Munich, and in 1858 he made another journey to the East, but soon succumbed to fever on the route from Beyruth to Mount Hermon.



Chitonia rubriceps, C.&M.



mmula purpurata, C. & M.

Botrytis corolligena, C.&M. x 200

Wyman & Sons. Ltd Lith. 9436

Aseroë rubra, La Bill.

Clavaria kewensis, Mass.

Wyman & Sons, Lt. Lith. 9436-6-9